

ENQUIRIES

INTO THE

NATURE

OF

A New Mineral Acid,

DISCOVERED IN SWEDEN;

AND

Of the STONE from which it is obtained.

To which is annexed,

AN IDEA of an ARTIFICIAL ARRANGEMENT,

AND OF

A NATURAL METHOD of FOSSILS;

WITH

EXAMPLES in the CRYSTALS, SPARS, and EARTHS.

By, SIR JOHN HILL.

L O N D O N :

Printed for T. TRUEMAN, in the STRAND:

M.DCC.LXXV.

Price One Shilling and Six-pence.

END OF THE

W. H. B.

A. M. C.

W. H. B.

F
th
n
in
ca

OBSERVATIONS

O N

The new-discovered SWEDISH ACID;

A N D O N

The Stone from which it is obtained.

S E C T. I.

Of the MINERAL ACID in general.

THERE exists in the Mineral World a native Acid ; and probably only one ; tho' it exhibits itself under different Forms.

Of the Existence of this we are certain ; altho' we never have seen it pure ; nor can : It never becoming an Object of our Senses, but in Mixture with other Bodies. It has been called the *Vague Acid*, and the *Universal Acid*.

We have been accustomed to meet with it under two distinct Forms; and to know it under the Names of two Species: These are the *Vitriolic* and the *Muriatic Acid*: And to these we are lately taught to add a third, which, from the Place where it has been discovered, Authors have called the *Swedish Acid*; and to which some, tho' very improperly, have given the Name of the *Sparry Acid*. Perhaps, in distinction from the other two, it may be better named the *Stony Acid*; since the Substance from which we obtain it is a Stone; tho' not a Spar.

There are many who hold these Acids to be essentially distinct. Perhaps they are so: But it seems more probable, that they are only different Modifications of one and the same Spirit: And perhaps it will not be carrying the Opinion too far to suppose this one universal Acid to be the Basis also, and Foundation of the nitrous; and even of the animal and vegetable Acids, the urinous, the fermented, &c.

Chymists of great Knowledge have proved the very near Relation between the vitriolic, and the nitrous Acid; and some by fair Experiments have also shewn there is a great Analogy between the nitrous and the marine or muriatic. They have endeavoured to prove, from these Experiments, that the nitrous, and the vitriolic on the one Part, and that the nitrous and muriatic, on the other, have so great Uniformity in many Instances, that they must be derived the one from the other: But
it

It should seem most agreeable to Nature, to refer both; as also the new-discovered Acid of Stone; to one and the same general Principle; of which they all three partake, altho' each has its own distinctive Qualities from the others; and to determine that they all originate from, or are merely different Modifications of, the same original Principle, the *universal Acid*.

This we may at all Times meet with in the three separate and distinct Forms already mentioned, vitriolic, muriatic, and stony; tho' no Man ever saw it separate and in its own. We see it,

1. Combined with Metal, under the Form of Vitriol.

2. With an alkaline Earth, in the Condition of Fossile or Sea Salt.

And, 3dly, With a stony Substance, under the Form of this new-discovered Stone.

From all these Substances we can obtain it by Means of Distillation; united with more or less Water. And this is the only Condition in which we have, or can have any Acquaintance with it. From whichever of these Substances we thus produce it, there are certain general Properties in which it agrees: As also certain Powers or Qualities by which it differs; according to the one or other of these Bodies from which it is drawn.

From whichever of these Substances it is produced, it is sour, acrid, and dissolvent; but in different Degrees, from the various

Kinds: And beside, it is separately endowed with different Characters from each.

Distilled from Vitriol, it is unctuous, heavy, and very corrosive: And after dissolving calcareous Earth, forms with it a Selenite. In its concentrated State it dissolves Silver, Tin, &c. when diluted, Copper, and Iron.

Distilled from Salt, it is not unctuous; is little heavier than common Water; less corrosive than from Vitriol; and after dissolving calcareous Earth, forms with it, not Selenite, but a fixed Sal Armoniac. In its concentrated State it dissolves Lead, &c.

Distilled from the *Swedish* Stone, it is heavier than Acid of Salt, less heavy than the Vitriolic. It dissolves the Calxes of Metals more readily than Metals themselves. In the very Act of Distillation, it corrodes Glass; and the Stone itself, mixed with a calcareous Earth, becomes a peculiarly corrosive Matter, which dissolves the best and strongest Crucibles.

S E C T. II.

Of the Stone from which the SWEDISH ACID
is obtained.

TH E Stone is of a peculiar Genus, differing both from Crystal and Spar; and demands a distinct Place and Name; as well from its natural Character, as for its artificial Products: It has been called *Fluor*, *Spatum vitrescens*, and *Fluss*. It is heavy, unctuous, soft, semi-transparent, and glossy: It breaks in a rudely plated Form; not rhombic.

We find it in large Masses; or Clusters of smaller Lumps; in some Degree resembling Spar, and of the like glossy Surface; but without the peculiar Form, or real Characters of that Stone.

A Knife will scratch it: It does not readily ferment with Acids, nor will it strike Fire with Steel: It neither burns to Glass, nor Lime; but exposed to the Action of a violent Fire, it splits into thin, irregular, flaky Fragments, and by Degrees crumbles into a Kind of Powder, over which the Fire has no farther Power. The Fragments do not this Way burn to Lime, nor can a calcareous Substance be any way extracted from them: But tho' no Fire will vitrify it alone, yet mixed with a calcareous Earth we see it runs freely into a Glass. And that it is of a
peculiar

peculiar Nature, and in particular so corrosive that it dissolves all Vessels, in this State; just as, mixed with the vitriolic Acid, it does the Glass of the Retort in the usual Distillation. Mixed with crude Ores, it wonderfully promotes their Fusion.

A Degree of Fire sufficient to make the Stone red hot, destroys that phosphoric Light it yields when gradually and gently warmed. Slowly heated, it is phosphoric, as long as it continues warm: And it burns with a blue Flame without Smell. From these invariable Characters it is plain, that it is neither Crystal, Spar, Talc, or Selenite; but a distinct Genus of Fossil from them all.

It is found green, yellow, white, blue, and violet coloured. The green and yellow are common in *Sweden*: There is a deep green in *Saxony*: The blue is frequent in *China*; and there is some in *Bohemia*: The white and the violet-coloured we have in *England*.

The fossile Bodies that approach nearest to its Nature, are the *Swedish* Zeolite; the *Bolonian* Phosphorus Stone; and our Star upon the waxen Vein.

But the Zeolite dissolves in Acids;

The *Bolonian* Stone effervesces readily with them, tho' it be not soluble; and the Star burns to Plaister.

No one of all which Properties belong to this new Stone.

The Zeolite is phosphoric, just as it melts;

And

And the Star does not dissolve or effervesce with Acids : In these Things the two approach to the new Stone ; but neither can be allowed the same.

The green owes its Colour, mostly, to Iron.

I am convinced that some of this Stone contains that Metal ; but not all ; and that the Iron, where it is found, is no Essential Part of the Body ; but a mere accidental Mixture : For I have Pieces from *Sweden*, which, tho' very green, do not become red in burning ; and other green Pieces that acquire that Redness, which appears after burning in all Fossils that have Iron in them.

The yellow holds a little Lead.

The blue does not owe its Colour to Copper ; as is true also of the *Lapis Lazuli* ; which is a Zeolite ; and therefore allied to this Stone.

Of whatsoever Colour this Stone be, if carefully warmed, it has the electric Quality ; less than the Tourmatine ; but like it ;

It has not the double Refraction of Spar ; though it has much of its external Aspect.

From these palpable Qualities ; and certain Characters ; we may advance toward an Enquiry into what it is.

The Mineral Acid, every where present in the Earth, (tho' never seen unmixed, or in its pure, simple state) when joined with Metals, we see, forms the Vitriols ; when united with Clay it makes the Alums ; when mixed with
any

any Thing inflammable, it constitutes the Sulphurs; and when united with calcareous Earth, the Selenites.

Now, as this Acid can unite with Clay, and with Chalk; there is nothing contradictory to Reason, in supposing it may join also with an earthy or stony Substance, neither argillaceous or calcareous:

And as uniting with Clay it forms Alums, and with Chalk Selenites; if united with an Earth totally different in its Nature from these two, it will form a Body also different both from Alum, and from Selenite.

I am therefore led to suppose, that this Stone is a Combination of the universal Acid, with an Earth, differing from those wherewith we have at other Times seen it joined.

And from

1. The unctuous Quality of the Stone;
2. Its Difficulty of Fusion;
3. Its tenacious and gelatinous Nature in the Fire;
4. From its various Colours;

I think it most probable, that it is the Mineral Acid united with the Steatite; or Soap Rock.

For the Steatites has precisely all the Colours which we see in this Stone; and has no others: It is unctuous like it; it scratches like it, in the hardest Pieces; it will not dissolve in Acids; nor strike Fire with Steel: And in the last fiery Trial it has just this refractory Quality; only that here it is rendered a little more tractable by the Acid.

A Stone thus formed must have Qualities very different from all others : And such this affords on Trial.

There rises from it in Distillation an Acid, different from the vitriolic, nitrous, or saline.

And also a solid Sublimation; of a Stone-like Nature; utterly unknown from any other Substance.

The Process by which I tried the Substance was this :

Two Pounds of the green Kind of the Stone were powdered, and put into a Glass Retort;

Two Pounds of Oil of Vitriol were added to this;

And a Quart of Spirit of Wine was put into the Receiver.

No Heat, nor Ebullition whatsoever, followed the Mixture for some Time; and in the End but little.

The Vessels were closed; and kept in a Reverberatory Furnace for fourteen Hours.

The Fire was slow at first; else the Matter would have risen over.

No phosphorescent Light was visible at any Time.

The Fumes were at some Times visible, in the Receiver; at others not. Whereas in the marine Acid they are never visible; unless Air be admitted.

They were elastic; and had a Smell like those from Spirit of Salt.

The Surface waved, and rose a little; and there was on it an icy, and gelatinous Substance.

The

The upper Part of the Receiver became covered with a thin stony Crust.

The *Swedes* speak of a Crust of absolute Flint, upon the Surface of the Liquor in the Receiver: But they put Water there: This was the same Substance: And it remained fix'd on Part of the Receiver: While Part was displaced; probably by some light Vapour from the Spirit of Wine.

The Corrosion of the Glass of the Retort seems to be an Effect of that peculiar Sublimation which rises in the Distillation; nay, and begins to rise, even without that Operation: For watching attentively the Effect of mixing the vitriolic Acid with the Stone, I perceived, that tho' they seemed to meet without any Effervescence, yet by Degrees there appeared a slight Commotion; which increased for a considerable Time, and, during which, this strange Sublimation of the Flores began to be made; and increased with it; even before any Fire was used.

Repeating this Trial, and breaking the Retort afterwards, no Fire at all having been used, I found it corroded in Waves; where the Flores had adhered to the Neck, and eaten in very deeply, just at the Surface of the Matter.

The Flores themselves are extremely acrid to the Taste, and are indissoluble in any Acid; nor can be run into Glass by any Fire.

The Acid of this Stone in its purest State, so far as I have seen it, is about one third heavier than Water.

After seven Hours a Hole was eaten thro' the Retort, and Fumes issued: But this was soon closed

closed by a Crust formed of the Matter within ; and so well stopped, that no Vapour escaped.

After this the Retort became corroded in a great many Places : Fumes issued, at them all, for a little While ; but they were afterwards stopped by Crusts of the same Kind as the former.

When the Operation was finished, there were found in the upper Part of the Retort a Kind of Flowers, dry and powdery ; and in the Neck a thick, slimy, moist Substance.

The Retort was corroded all round, just above the Top of the Residuum ; and this corroded Part crumbled to Dust between the Fingers ; having lost the Nature of Glass.

Here then is found a Fossil capable of dissolving Glass ; a Power not known in any other Body :

Subliming an absolute Stone during the Distillation ; a Quality equally unknown in other Bodies :

And burning with a violet, scentless Flame : A Thing equally unknown ; and the more strange, as the Stone holds no Copper.

To shew the violet Flame, some of the Stone is to be broken small with a Hammer ; and sprinkled on a red hot Heater, in the dark : The Flame rises very freely, and continues some Time ; and the Stone splits into thin irregular Flakes

The Uses of the pure Acid may be infinite : And it is easy to see the Knowledge of this Subject will lead us to a thousand unknown Truths in the Mineral History.

The

The Uses of the Stone itself may also be immense. We are well informed that the Steatites, and a Fossil of the Nature of the *Bolonian* Stone, are great Ingredients in Porcelaine. This Substance seems to promise all that can be wished, without any farther Mixture. For the Matter in the Neck of the Retort, when hardened, differs little from the Substance of *China* Ware.

In Mineralogy there are laid open to us also a thousand Articles of Wonder; which naturally perplexed us before we were acquainted with this Stone: Because, not knowing this, which was the true Source of them, it was impossible that we should guess how they were performed.

LEHMAN, in a very excellent Letter to *Monf. BUFFON*, on the Subject of a red Ore of Lead found in *Siberia*, entertains a Conjecture, not only that this in particular, but many others, owe a great deal of their Qualities and Particularities to the Marine Acid. The Conjecture was good; but 'tis easy now to see, by numerous Instances, that the Acid, suspected by many, and absolutely discovered by this able Chymist, as performing many and great Things in the mineral World, is not the muriatic, but this stony Acid; present in a thousand Places where we do not suspect it; and performing a Multitude of Things which must have been unintelligible, and therefore wonderful to us, so long as we were not acquainted with it; or indeed knew of its Existence.

A N

I D E A

O F A N

ARTIFICIAL ARRANGEMENT of FOSSILS,

According to Unalterable Characters, and superadded Qualities :

A L S O

Of a NATURAL METHOD; according to their Ascent toward their greatest Perfection.

FOSSILS may be arranged, according to the following *permanent* Characters, into
TWO SERIES,

1. *Simple,*
2. *Compound,*

According to the *Purity* or *Mixture* in the Body.
Each of these into Five TRIBES, by
Adding the Ideas of

- | | |
|-----------------|----------------------|
| 1.—Vitrifiable, | 4.—Incombustible, |
| 2.—Inflammable, | 5.—Soluble in Water, |
| 3.—Calcinable, | 6.—Metalline. |

These into ORDERS, by superadding the Idea of

1.—Pellucid,	4.—Alkaline,	7.—Plated;	10.—Uniform,
2.—Opake,	5.—Solid,	8.—Thready,	11.—Malleable,
3.—Neutral,	6.—Fluid,	9.—Granulated,	12.—Friable.

These into GENERA, by superadding the Idea of

1. Form. by Trial by Acids,
and by Steel.

These into SPECIES, by superadding the Idea of

1. Gravity.

These into VARIETIES, by superadding to all this
the Ideas of

1. Colour from Mixture.
1. Shape from Mixture.

And these into VARIETIES OF VARIETIES, by super-
adding the Ideas of

1. Colour from double Mixture.
2. Shape from double Mixture.

And under these come all Individuals.

B

EXAMPLE.

EXAMPLE.

From the most complete of the Tribes.

An *unorganized natural Body*, is a FOSSIL.

Add the Idea *pure*,

It becomes *Simple Fossil*. This is its SERIES.

Add to these *calcinable*,

It becomes *Limey Fossil*. This is its TRIBE.

Add to these *pellucid*,

It becomes *light Limey Fossil*. } This is its ORDER.

Add to these *soluble in Acids*,

It becomes *light Limey soluble Fossil*. } This is its FAMILY.

Add to these again *transparent*,

It becomes *Spar* *. This is its GENUS.

Add to these a *columnar Figure*,

It becomes *Columnar Spar*. This is its SPECIES.

Add to these a *yellow Colour*,

It becomes *Topazine Spar*. This is a VARIETY.

Add to these a *blue Colour*,

It becomes *Smaragdine Spar* †. } This is a VARIETY of a VARIETY.

After this there can be only the Difference of Bigness ; and that distinguishes Individuals.

* Here Fossils begin to have distinct Names.

† The Blue mixt with the former Yellow producing a Green.

F O S S I L S.

Series 1.—Simple.

Series 2.—Compound.

SERIES I. Simple Fossils.

Tribe 1.—Vitrifiable	<i>Crystal.</i>
2.—Calcinable	<i>Spar.</i>
3.—Inflammable	<i>Sulphur.</i>
4.—Incombustible	<i>Talc.</i>
5.—Soluble in Water	<i>Salt.</i>
6.—Metalline	<i>Ores.</i>

T R I B E I.

Simple Vitrifiable Fossils.

Order 1.—Pellucid	<i>Crystal.</i>
2.—Opake.	<i>Earth neutral.</i>
Family 1.—Brittle.	
2.—Tough.	

T R I B E II.

Simple Calcinable Fossils.

Order 1.—Pellucid.	
2.—Opake.	
Family 1.—Soluble in Acids.	
2.—Indissoluble.	

TRIBE II. ORDER I. FAMILY I.

Simple calcinable Fossils soluble in Acids.

- | | |
|--------------------|-------------------------|
| Class 1.—Pellucid. | <i>Spars.</i> |
| 2.—Opake | <i>Earths alkaline.</i> |

FAMILY II.

Simple calcinable Fossils not soluble in Acids.

- | | |
|-----------------|-----------------------|
| Class 1.—Plated | <i>Selenite.</i> |
| 2.—Thready | <i>Striated Talc.</i> |
| 3.—Granulated | <i>Plaster.</i> |

TRIBE III.

Simple inflammable Fossils.

- | | |
|----------------|-----------------|
| Order 1.—Solid | <i>Sulphur.</i> |
| 2.—Fluid | <i>Naphtha.</i> |

TRIBE IV.

Simple incombustible Fossils.

- | | |
|-----------------|------------------|
| Order 1.—Plated | <i>Talc.</i> |
| 2.—Thready | <i>Asbestos.</i> |

TRIBE V.

Simple soluble Fossils.

- | | |
|------------------|-------------------|
| Order 1.—Neutral | <i>Rock Salt.</i> |
| 2.—Alkaline | <i>Natrum.</i> |

TRIBE VI.

Simple Metalline Fossils.

- | | |
|--------------------|---------------------|
| Order 1.—Malleable | <i>Metals.</i> |
| 2.—Friable | <i>Semi-metals.</i> |

SERIES

S E R I E S II. COMPOUND Fossils.

Tribe 1.—Earthy	<i>Loams.</i>
2.—Stony	<i>Stones.</i>
3.—Metalline	<i>Ores.</i>

T R I B E I.

Compound Earthy Fossils.

Order 1.—Firm in Water	<i>Loams.</i>
2.—Swelling in Water	<i>Marles.</i>

T R I B E II.

Compound stony Fossils.

Order 1.—Vitrifiable	<i>Stones.</i>
2.—Calcinable	<i>Marbles.</i>
3.—Saline	<i>Alum Ores.</i>

T R I B E III.

Compound Metalline Fossils.

Order 1.—Sulphureous.
2.—Saline
3.—Arsenical.

F O S S I L S,
SERIES I. TRIBE I. ORDER I.

Simple vitrifiable pellucid Fossils.

GENUS I.—Gems.

Generic Character.

Untouched by Acids, giving Fire with Steel;
hard, bright.

SPECIES I.—Diamond.

Specific Character.

An Octohædron of unequal Sides, impenetrable, colourless, pellucid.

VARIETIES

1. In Shape.

1 *. Columnar Diamond.

A Column of six Angles with two short Pyramids.

2.—Squared Diamond.

A Column of four Angles, with truncated Ends.

3.—Pebble Diamond.

Without Angles, rounded or irregular.

2. In Colour.

4 †. Red Diamond.

Diamond coloured by Gold.

5.—Yellow Diamond.

Diamond coloured by Lead.

6.—Blue Diamond.

7.—Green Diamonds.

Diamonds, both coloured by Copper.

Variety of Variety.

8.—Purple Diamond.

Diamond coloured by Gold and Copper.

1 *. Common Salt will shoot in Cubes, Pyramids, and Parellopipeds, but it is still common *Salt*; the same *Species* of Body under this Variety of *Form*.

4 †. Colours are Additions to the *Body*, not Changes of the *Species*.

SPECIES 2.—Sapphire.

Specific Character.

A hexangular Column of six unequal Sides tapering from the Base, and terminated by a Pyramid of the same Angles, colourless, pellucid.

VARIETIES.

1. In *Shape*.

1.—Pyramidal Sapphire.

An hexangular Pyramid of unequal Sides.

2.—Columnar Sapphire.

An hexangular Column of unequal Sides, with two low Pyramids.

3.—Pebble Sapphire.

Without Angles, of an oval flatted Shape.

2. In *Colour*.

4.—Red Sapphire, called Ruby.

Sapphire coloured by Gold.

5.—Yellow Sapphire, called Topaz.

Sapphire coloured by Lead.

6.—Blue Sapphire, called Sapphire.

7.—Green Sapphire, called Emerald.

Sapphires both coloured by Copper.

8.—Flamy Sapphire, called Hyacinth.

9.—Crimson Sapphire, called Garnet.

Sapphires both coloured by Iron.

Varieties of Varieties.

10.—Firey Sapphire, called Carbuncle.

Sapphire coloured by Gold, with a little Copper.

11.—Purple Sapphire, called Amethyst.

Sapphire coloured by Iron and Copper.

12.—Blue green Sapphire, called Aqua Marine.

Sapphire, coloured by Copper and Lead.

13.—Yellow green Sapphire, called Chrysolite.

Sapphire coloured by Copper and more Lead.

14.—Coarse green Sapphire, called Prasius.

Sapphire coloured by Copper and Manganese.

These are the Oriental Gems.

They are all found in pebble or columnar Forms; singly and in Clusters; and of different Bignesses.

There are also Crystals of these Colours, which are called occidental Gems of the same Names.

We know the Ingredients which give their Colour, by Experiments in colouring Glass and Pastes.

These with the Colour give no Addition of Weight.

There is beside all these a debased Sapphire, fouled by Earth.

SPECIES 3.—Crystal.

Specific Character,

An hexangular Column of six equal Sides,
of the same Thickness from End to End;
and terminated each way by an hexangular
Pyramid; colourless, pellucid.

VARIETIES.

I. In *Shape*.

^a By Accident in their Concretion.

Perfect,

1.—Close Crystal,

A Crystal of 18 Planes in a short Co-
lumn, and two long Pyramids,

Wanting the
intermediate
Column,

1^b.—Gibbous Crystal.

2.—Bellyed Crystal,

of 12 Planes, in two hexangular
Pyramids, base to base.

3.—Edgy Crystal,

of 16 Planes, in two octangular
Pyramids, base to base.

Wanting the
lower Pyra-
mid,

4.—Spiry Crystal,

of 12 Planes in a hexangular Py-
ramid, on an hexangular Co-
lumn.

5.—Broad Crystal,

of 10 Planes in a pentangular
Column, and pentangular Py-
ramid.

6.—Planed Crystal,

of 20 Planes in decangular
Columns, and decangular Py-
ramid,

7.—Oblique

7.—Oblique Crystal,
A Crystal of 12 Planes, with the Pyramid
set on obliquely.

^b By the Influence of Metals.

8.—Cubic Crystal.
Crystal shaped by Lead.

9.—Pyramidal Crystal.
Crystal shaped by Tin.

10.—Rhomboidal Crystal.
Crystal shaped by Iron.

^c Unshaped.

11.—Pebble Crystal.
Crystal without Angles in roundish Masses.

Varieties of Crystal.

2. In *Colour*.

12.—Yellow Crystal, called Occidental
Topaz.

Cystal coloured by Lead.

13.—Blue Crystal, called Occidental
Sapphire.

14.—Green Crystal, called Occidental
Emerald.

Crystals both coloured by Copper.

Variety of Varieties.

15.—Purple Crystal, called Occidental
Amethyst.

3. By Impurities.

16.—Whitish Crystal.
Crystal debased by a white Earth.

17.—Brown Crystal.
Crystal debased by a dusky Earth.

Upon

Upon this Plan it will not not be difficult for an accustomed Mind to arrange the whole Fossil World : and this may serve to give the intended Idea of an artificial Arrangement.

A general Instance of the Method of finding the Places of the several Species, may be seen in the Exordium of the *Spatogenesia*. As for Example :

Of the ORIGIN of SPAR.

The Series of Fossils make one great Circle ; for ever returning into itself.

There are a few primitive Bodies ; Chalk, Clay, Bitumen, Talc, and the Mineral Acid.

These, variously mixed, form many different compound Fossils : Which mingling, in some Places, farther with one another, give Decompositions.

These (in other Places) give up their several Primitives again to Water : Which delivers them pure in some other Parts ; ready to form mixt and compound Bodies again.

To trace them thro' these Combinations, and to their natural Analysis again, is the whole Business of the Student in this Science : For here is no Distinction but by Mixture : No Origin from Egg, or Seed.

A great deal of pure Clay mixed with a little Quantity of various Stones, forms the different Clays.

And a great deal of Stone with a little of the Clays, forms the various Species of Stones.

An

An Instance of this Course of Nature appears in the philosophic History of Spar.

1. The Primitives, as we have seen, are *Water, Bitumen, Chalk, Clay, Talc,* and *Mineral Acid*: To these the Operations of the Air, and Fire give great Powers of acting. We thus find

2. *Heavy Vapours*, formed of Air, and much Water. These, pervading all Things,

3. Meet the Mineral Acid *, and uniting with it; if they run clear to the Surface, afford Medicinal Springs; but

4. Thus united, they may fall upon Bitumen: This is no where more frequent than in Limestone Rocks; and often stands in Puddles, in their natural Hollows †.

5. By this Mixture, uniting in its Course, is formed a real, tho' a fluid Sulphur: For Sulphur is nothing else; nor can be formed by any other Means ‡.

6. This Sulphur, not yet concreted, passes in its liquid Form thro' the Pores of the Lime-

* The Electric Æther of the under World; present every where, but only seen concentrated, or in its Mixtures. It affects some Things, Bitumen most; And avoids others.

† At *Naples*; in the *Venetian Territories*; and in *Persia*, this is very common.

‡ Absolute Sulphur may be made by Art with Ease and Certainty this Way. The Acid of Vitriol, with any Thing inflammable, affords it.

stone;

stone; dissolving Part of its purer Chalk as it goes *.

7. Water thus saturated with the Principles of Sulphur, and with Chalk, keeps on its gradual Course horizontally thro' the same Lime Rock, till it meets a Fissure; a perpendicular Crack, or Opening; dividing one Part of the Rock from another. Here it ouzes forth: and meeting with a lighter Air, hangs; and evaporates slowly.

8. Slow Evaporation, and perfect Rest, are the Requisites of Crystalization. The Sulphur and pure Chalk thus united, form one solid Body; which crystalizing gradually, appears in regular rhomboidal Particles: and is the Substance we call Spar †.

* Limestone is only coloured, hardened Chalk; and Marble is the same. Marble is a purer Limestone, and Limestone a coarser Marble.

† Spar supposed to be one Thing, is therefore a mixed Body, and so are the purest Salts. We can make a Substance of the Nature of Spar, by crystalizing the Lixivium of Lime and Sulphur.

NATIVE FOSSILS.

CLASS III.

SPAR.

SPATUM.

A pure Fossil ; composed of Brittle Rhombs.

SPAR is known from Talc by its Want of Elasticity ;

——from Selenite by its Want of Flexibility ;

——from Crystal by its Dullness, and by fermenting with Acids.

It is heavier than any of the three other pellucid Fossils ; and is known from all Bodies in the World (when pure enough to be seen through) by its doubling Lines laid under ; and viewed through it.

This last Property has been supposed peculiar to that Species of Spar called Island Crystal : And the greatest Writers, *Linnaeus*, *Wallerius*, *Cronstedt*, and the long *et cætera*, have separated

that Body from the pure Rhombic Spar; which they supposed not to have the double Refraction. But this Power resides in all Spar I have examined: And is of its Nature: As it arises from the internal Construction of the Body, which is made up of smaller Rhombs, applied one to another.

The very Atoms of Spar are Rhombic; and those smallest Pieces into which it may be separated by gentle Acids, without Solution, applied to the Microscope over a Line proportionably fine, have the same Power.

No Body has this Construction except Spar; therefore no other natural or artificial Substance has this Power of double Refraction. Even Sir *Isaac Newton* has said, Crystal has something of this Power; in vain: For no Authority can stand against the Testimony of the Senses. All different Mediums vary in Refraction; but this peculiar Power resides only in a pellucid Body formed of connected Rhombs.

The State of Refraction in the pellucid natural Bodies is this,

1. Talc in thick Masses elevates the Line.
2. Selenite waves it.
3. Crystal distorts it.
4. Spar gives it double.

All Spar does this, even that which takes the Form of Crystal, in Pyramids, and Columns: Therefore even the variously angulated
Forms

Forms of Spar are composed of Rhombs; and the Construction of Spar, and of Crystal, are perfectly different, even while their Forms are the same.

Spar is seldom found original, and free: A few pure Rhombs; and two Columns, double pointed, which were dug in the Hartz Forest; are all I have of it.

Nature has mixed its Particles among the Matter of the Marbles and Limestones; from whence it is washed forth by the pervading Water, and left slowly by it, in their Cracks and Fissures; where it assumes these various Forms:

1. Pure Rhombs of a larger Size.
2. Rude Masses, formed of coarse connected Rhombs.
3. Plates composed of connected Rhombs.
4. Columnar, Pyramidal, and Cubic Figures, fixed upon the Surface of these rude Masses*.

In this latter Case the rude Mass continues uncoloured, and is the Root; and the columnar or pyramidal Figures rise from it frequently yellow, often of other Colours: These cut into a Kind of Gems, but still have the double

* The Stone from which the *Swedish* Acid before described is obtained, has been added to these; but erroneously. It is a distinct Body.

Refraction equally with that Part we call the Root.

5. Icicles and Dropstones.

That the Spar formed in Fissures of Rocks, is thus washed out of the Limestone itself is certain ;

Because none but Limestone Rocks have Spar in their Fissures ; Rocks of Crystalline Matter, or formed of vitrifiable Stone, have Crystal ; never Spar in their Cracks.

Linnaeus wonders at the Nature of that Force which split the Rocks into these Cracks : But probably the Cause is very familiar ; they were formed moist, and cracked in drying.

Spar grows continually ; for wheresoever there is a Crack in a Limestone Rock, new, or old ; Spar always fills it ; and over-runs the Surface.

Letters cut hollow in a living Rock of Limestone, fill up, in a Course of Years, with Spar ; and what were made in Creux are found in Relief. This has been seen in *Gothland* by the eminent *Swede* ; and in the Grotto of *Antiparos* by *Tournefort*. The very Time may be determined by the Dates, which are often a Part of the Inscription ; but it is always long. The Spar stands higher as the Time is more distant : and has been seen in some Places a Quarter of an Inch above the Level of the Surface.

If there could want a Proof of the continual Growth of Spar, the Stalactites would shew it ; and the Incrustations, in what are called our

petrifying Springs; but that is a fouler Sort: There is in *Norway* a Pyramid of Spar two Inches long, which was once mine; in which two Branches of the solid Heath Moss, or Lichen, are perfectly embodied.

It has been thought the Spar in Cracks of Rocks was brought from elsewhere by Water; or was and is originally in all Water: The latter is the Opinion of *Linnæus*; *Henkell* maintains the former. But if either were the Case, Spar would be sometimes found in vitrescent Rocks, and Crystal in those of Limestone; which Observation denies.

Spar they say will be formed where Water can be retained; but indeed also where it cannot; 'tis enough that it ouzes slowly: Nay, not Water alone dissolves Spar; but it can be retained in Vapour. I have from *Cornwall* Incrustations of true Stalactite, formed in the Pipes of Fire Engines in the Mines, at Heights to which the Water never ascends, by many Feet; but only Vapour.

Mundick is also thus a Creature of the Air, in many Places. I have trigonal Pyramids of Spar, which hung from the Top of the *Bauman's* Cave, in the *Hartz*, covered with Cubic Mundick; there is none in the Spar itself; and from the particular Circumstances of the Specimen, Water could not have lodged upon it, only Vapour.

Spar is one Thing, of one Weight, one Hardness, and when pure can never be mistaken for any other Fossil. It is liable to have
other

other Bodies mixt with it; and to be altered in its Condition by that Mixture: But 'tis itself the same. *Wallerius* distinguishes three Degrees of Hardness in this Fossil; but they are owing to those Mixtures; the least hard is the true Condition of Spar; the other Degrees arise from Iron, or other Additions.

It is the Opinion of *Linnaeus*, that Spar owes its angulated Form to Sea Salt; and the Crystals to other Salts: But there is no Warrant in Nature for this Judgment. Salts are acrid, and dissolve in Water. These Fossils have neither of those Qualities: And who shall tell us that the Property of forming itself into regularly angulated Figures is peculiar to Salts? We have no Authority to believe it is wanting in Crystal, and Spar; and we have the Evidence of our Senses that they have it.

The ingenious and ingenuous *Cronstedt* well observes, these Figures ought not to be ascribed to Salts, till the Presence of such Salts can be proved in them.

The calcarious Nature of Spar is of its Essence; and no Form, nor all the other Characters in the World, could constitute a Thing a Spar that wanted this. They all ferment with Acids, and they burn to Lime: Nor is this latter Quality equivocal, as some would think, because by the Fire of a great Burning Glass, Spar vitrifies. This is not the Fire, when we speak of Lime; and it can be a Test of nothing because all Things vitrify before it:

That is the extreme Force of Fire: And the ultimate Effect of Fire on all Bodies is Vitri-
fication.

Linnaeus says, the Spar he calls *Natro-spatosum*, scarce does effervesce with Acids: And it may be added, that the Particles of that Spar are scarcely at all rhombic: Spar and Crystal are mixt in those Bodies; and they have mixt Qualities; but still as there is some Spar, there is some Effervescence.

'Tis vain to give the Forms of Spar to Natrum; for we not only find no Natrum there, but different Spars have Forms of different Salts; and the great Patron of the Salt System allows, that some of them affect the various angulated Figures of Alum, Sea-Salt, Vitriol, and the rest. 'Tis true, they resemble those Forms; but they have not those Forms exactly: Nor is either of these, or any other Salt whatever, to be found existing in any of them.

But whither will not the Wind of Theory blow even the steadiest Judgments? The foremost of the Writers, who favour this System, because there are in Spars certain Forms that do not agree with those of any known Salt, fancies for the Formation of these that there exist Salts, not otherwise known to us, but by this Operation. When Theory can reach this Heighth, it may do what it pleases: To create Causes, because we see Effects that seem to us to require them, is to make all Things easy; and at the cheapest Rate.

If

If we can ever bring Spar, after Solution, to recrystallize, as Salt; we shall see all Things explained in this Particular. 'Tis what I have tried four Years, with poor Success; and I have now requested the ablest Chymist that we have, to join with me in the Attempt. What may arise under his experienced Hand, I know not: All I have found is, that the swifter the Fluid is evaporated, the coarser is the Matter left behind; and the more Length of Time is given, the nearer it approaches to a Promise of Crystals.

I think when this shall be accomplished, we shall find all Spar to be but one Thing; differing only according to the other Matters mixed with it. 'Tis said, the Selenite powdered and mixt in Water affords Crystals; and *Kabler* gives the Authority of an eminent Metallurgist for it: With me neither has this succeeded yet: But I have no Despair; and tho' it never should succeed with me, it may with others: When that is seen, the other, more important as it is, need not be supposed impossible.

Nothing is more familiar than the Production of what it is the Custom to call, Selenitical Salts; Urine affords them; and some Preparations of Sulphur; but to recrystallize Selenite is, to produce, from a clear Fluid, pellucid dodecahedral Rhombs, flexible, not elastic, and not soluble again in Water: And he who shall effect this, need not despair of recrystallizing also Spar.

The Salts in Urine that has stood long come nearer the Nature of Fossils than any Thing we know; and Tartar, formed from Wine, is very difficult of Solution: Yet both these may be melted in pure Water. The Salt produced by slow Crystallization from a Lixivium of Lime and Sulphur, comes nearest of all to Spar; but still it is but an Approach; and not a Sameness: As he who is well acquainted with all the Qualities of the vitriolated Tartar will perceive: Nor do I conceive *Henkel's* Receipt, formed on the same Foundation, would go any farther: But till Men speak plain, 'tis vain to war against their buried Meaning.

In fine, the Formation of Spar is yet a Subject of Enquiry: Its Atoms are all Spar; each Particle into which we can without Violence divide it, is the same in all Respects as the Whole: And as the Fossil World admits no Generation, or Birth, by Egg, or Seed, it seems most probable that all the Variety of Forms in which we see this Protean Mineral, are owing to no Cause beside the Arrangement of Rhombs into as many Forms as they are capable of producing. It fills the Cracks of its own Rocks: And of no other: For Crystal Columns rise from crystalline Rocks; and from metallic Masses, fractur'd, grow Pyritæ; each separated from the great mixt Body we see split; and each formed into Figures by its own Laws, without the Intervention of Salt, or other Matter.

We

We find hollow Crystals, and we have hollow Pyramids of Spar; but 'tis a rash Thought, tho' of a great Man, to imagine that a Crystal of Salt was first formed in these Cases; and when the stony Coat was finished over, it melted away again: This is Imagination: But there is not a hollow Stalactite that may not shew the Senses, and convince the Reason, that this Shell of Spar, or Crystal, may be formed without a solid Nucleus.

There are no entire Rocks of Spar; and they who thought they had seen such of Crystal, perhaps mistook pure Ice for them. Both Spar and Crystal rise in general from foul Stones; and they who thought Ice grew to them in Time, were scarce more pardonable than such as took Ice for them. *Scheukzer* has seen the Difficulty of accounting for their Forms, and joined the Lamentation of Philosophers upon that Subject; for the Salt System was not then in being: But the old *Pliny* has not only lamented this Difficulty, but assigned its Cause; and this a Cause to overthrow that System utterly: It is, that tho' the Figures be all regular, they are not all alike; or all resolvable into the same Laws.

'Tis an invidious Office, and unpleasing, to dwell upon the Errors of those who wrote before; but these are so received, and so established, that there is no other Way to Truth.

Wallerius says, that Spar is composed of rhombic and pyramidal Particles: And there-

fore breaks into both these Forms. It is unwillingly I dissent in a few Particulars, from an Author with whom Reason and Observation command me to agree in a great many: But this is a Doctrine which strikes at the Root of all accurate Knowledge in respect of this Body.

By this Account Spar would be two Things, not one: Its Atoms would have two Figures; and we should lose the great Distinction by which it is kept separate from all other Bodies. I have examined this Point with all possible Attention; and find the pyramidal Figures of Spar, whether in greater or smaller Pieces, to be a secondary Form; composed always of Rhombs: But the rhombic Figure never to have any Form in its constituent Parts beside its own. The Pyramids, great or small, separate into Rhombs; the Rhombs never into Pyramids. The true Way of dividing Spar is, by an Acid, carefully managed; for the Parts are always separated, before they are dissolved.

It is a singular and a just Observation of the same Author, that no pentagonal Spar has ever been found; tho' Angles in most other Numbers are frequent; but this is not to be attributed with him, to an imaginary Salt, Alkaline, and Muriatic; it rests upon a much more solid Base: Which is, that the particular Figure of the Rhombs of Spar, admit the constructing any other angulated Form, only not pentagonal.

It

It has been said, that Island Crystal shines in the Dark after it has been calcined in Manner of the *Bolonian* Stone; but this is not particular to that Species: It is the Quality of all Spar as Spar; only there requires great Nicety in the Calcination: Perhaps Selenite also has this Power. *Linnaeus* refers the *Bolonian* Stone to Spars: To me it has appeared rather a Selenite; and of all Bodies in Nature, most of Kin to that Species of Selenite we call the Star, upon the waxen Vein. I have therefore retained it in that Place, till more of this scarce Fossil comes in my Way for Trial: If it proves Spar, 'tis easily removed into that Class; and thus, and only thus, we can arrive at Truth; after a thousand Errors.

That the Hog Spar affords Flowers on Sublimation, has been urged as a great Proof of its containing Salts of some Kind or other; known or unknown: But surely this Property is more naturally resolved into another Source. All Bitumens yield Flowers on Sublimation; and we have the Testimony of our Senses to the Presence of a Bitumen in the *Lapis Suillus*: It stinks of it. Nay more, there is a Smell of Sulphur in all Spar, when calcined: *Henkel* and *Wallerius*, as well as I, have found it; and if we could give way to any Thought of secondary Forms in a Fossil whose Construction appears perfectly homogeneous, and simple, my Sense of it would be, not to seek them in imaginary Salts, but real Sulphur.

We

We see the Way Art imitates it best, is by the Crystals of a Liquor in which Lime and Sulphur have been boiled. Sulphur is thus disclosed on the calcining of Spar; and for the other Ingredient, Lime, we cannot be at a Loss; since it has been observed, no Spar is ever produced in Cracks of any Rocks, except those of Limestone: Nay, and what may strengthen this Opinion, the Lime of Spar is weaker than that of Limestone, which a little Sulphur may cause. All this, is but Conjecture; and is delivered as such, and no other; but yet it rests on the Testimonies of the Senses; not on the Flights of the Imagination: And it is by Conjecture, in these dark and difficult Researches, we must arrive at Truth.

I claim no better Authority for many of the particular Observations here, than for this general one; they are indeed all founded on Examination, and Experiments, now made on the Occasion; but they are Examinations and Experiments made only on the Bodies in my own scanty Store: I invite, I solicit, and intreat with my best Earnestness, others to repeat them on their own. If they answer as in mine, the Doctrines are established; if they differ, there is no one in the World to whom that Truth will be more welcome than to myself. To equivocate about an Error, is pitiful: to attempt to justify it, is disingenuous: No Man should be ashamed of setting right his own Mistakes (especially in
Matters

Matters where Mistakes are unavoidable) whether by his own or others Observation. With how many hundred Errors did the *Species Plantarum* make its first Appearance; how many of them have been rectified; and how many yet remain to be set right? Yet no one ever blamed *Linnaeus* for his first Conjectures; nor has the World seen any other Book of Science of equal Value.

Such Errors are the Children of imperfect Information; and must be found in all who attempt to write for general Utility.

Let others therefore freely repeat these my Experiments, and add more of their own; and with an honest Freedom tell the Result of all. My single Attention can only make a few Experiments, where true Knowledge demands a thousand: But the Result of different Trials will bring forth Truth.

It never was more needed in Philosophy than in the Part before us; for with all the Plausibility of System, we cannot but perceive, upon this free and fair Enquiry, that the Student in Fossils has yet to work upon a Chaos: And that the Paths into a better Light, are stopped and closed up utterly: Not by Ignorance; but what is much worse, by authenticated Error; authenticated even by greatest Names. We must unwind this Charm, if ever we hope to gain the right Clue to lead us thro' the Labyrinth of Nature: We must break the fated Talisman; and all the seemingly impregnable Structures

Structures will vanish: The Ground will be clear before us; and if we lose ourselves in the open Way, 'tis easy to be set right again.

Spar formed by Nature, as above related, may either concrete in its pure State as soon as made; or it may pass, while yet fluid, thro' various Strata of earthy, saline, Mineral, and other Matter, and receive great Changes both in Form and Colour from them: It may appear to us therefore, according to these Circumstances, either

in its own pure State of a colourless Rhomb;
 or foul'd by Earths; or tinged by Metals;
 or plated, by an Admixture of Talc;
 or rendered cubic by the Natrane Marle;
 and those Cubes stained to a Mimickry of Gems by Metals;
 or it may be shaped into Polygons by an aluminous Earth;
 or thrown into Pyramids, with or without Columns, by the Salts of Mineral Waters:

Or from the mere Nature of its Concretion, it may appear as Curtains spread upon a Wall;
 as Icicles hanging from a Roof;
 or Globules drop'd upon the Floor;
 or as a Coat upon Mosses, or Shells, or various other Matters.

According to these Accidents it may be thrown into a Kind of Method, under the Terms Genus and Species, to great Advantage.
 The

The obvious Characters giving an artificial Method; and the Consideration of their Origin a natural one.

Nor is it more difficult, with due Care and Attention, to follow the several other Fossils thro' their gradual Approaches to Perfection, in their various Kinds; and by marking the Degrees and Steps of this Ascent, to lay down a sure Foundation of the most desirable of all Attainments in this Study, a natural Method: Dividing them into Genera, Species, Varieties; and a yet subordinate Distinction to all, Varieties of Varieties. For Instance;

Genus.

Genus. Species.

Variety.

Marles,

In their Ascent to Ochre, assume the following Names and Characters :

1. White Marle—*Melinum* of the Antients.

This takes in *Chalk*, and becomes,

The CIMOLIA of the Antients.

Bole, and becomes,

The COLLYRIUM SAMIUM of the Antients.

Clay, and becomes,

The MARGA FUNGOSA.

Spar, and becomes,

LAC LUNÆ.

Talc, and becomes,

The ASTER SAMIUS of the Antients.

2. Brown Marle—*Fullers Earth*.

This takes in *blue Clay*, and becomes,

The BLUE MARLE of *Staffordshire*.

brown Clay, and becomes,

The BROWN MARLE of *Suffex*.

Sand, which is Crystal, and becomes,

The TERRA SAPONARIA of *Kentman*.

3. Red Marle—*Reddle*.

This takes in *Fullers Earth*, and becomes,

The MARGA SAXATILIS INCARNATA of *Wormius*.

Bole, and becomes,

The RUBRICA FABRILIS of *Kentman*.

Clay, and becomes,

The RED STONY MARLE of *Yorkshire*.

4. Black Marle.

This takes in *decayed Animals and Vegetables*, and becomes,
GARDEN MOULD.

This is shown by their Decomposition; and proved by their specific Gravities.

Variety

Variety of Variety.

This *Cimolia*, taking in *Bole*, becomes,
The 'TERRA MELITENSIS of the Shops.

This *Fungosa* takes in *Chalk*, and becomes,
The TERRA CHIA * of the Shops.

This *Lac Lunæ* takes in *Chalk*, and becomes,
The GYPSUM TYMPHAICUM of
the Antients.

This *blue Marle* takes in *Morochthus*, and becomes,
The MARGA COLUMBINA of *Pliny*.

This *brown Marle* takes in *Chalk*, and becomes,
The MARBLED MARLE † of *Yorkshire*.
yellow Clay and Sand, and becomes,
The YELLOW MARLE of *Suffex*.
Clay and Selenites, and becomes,
The STONY MARLE of *Staffordshire*.

This *Saponaria* takes in *White Tripela*, and becomes,
The TERRA NOCERIANA of the Shops.

This *Rubrica Fabrilis* takes in *Clay*, and becomes,
The HEAVY RED MARLE of *Kent*.
Red Bole, and becomes,
The ALMAGRA ‡ of *Spain*.

* This *Chia* takes in white *Bole*, and becomes,
The PIPE EARTH of the *Isle of Wight* *.

† This *marbled Marle* takes in *Sea Shells*, and becomes,
The SHELLY MARLE of *Suffex*.

‡ This *Almagra* takes in *yellow Sand*, and becomes,
The SIL SYRICUM of the Antients.

* A most amazing Mixture; but proved by the irrefragable Testimony of
separated Parts and their specific Weight.

Ochres,

Genus. Species.

Variety.

Ochres,

In their *Ascent* to *Tripelas*, assume the following Names and Characters.

1. White Ochre—The *Terra Melia* of the Antients.
2. Yellow Ochre—The *Oebra Attica* of the Antients.
This takes in *Bole*, and becomes,
The HARD OCHRE of the Painters.
This takes in *Iron*, and becomes,
The PENNSYLVANIAN OCHRE *.
3. Red Ochre—The *Sil Atticum* of the Antients.
This takes in *Spar*, and becomes,
The FLORIDA OCHRE.
Clay, and becomes,
The RED VIRGINIAN OCHRE.
4. Purple Ochre—The *Terra Sinopica* of the Antients.
This takes in *Crystal*, and becomes,
The SIL MARMOROSUM of the Antients.
Iron, and becomes,
The OCHRE OF DEAN.
5. Brown Ochre—*Umber*.
This takes in *putrified Wood*, and becomes,
COLOGN EARTH.
- 6.—Green Ochre—The *Lapis Armenus* of the Antients.
This takes in *white Sand*, and becomes,
The GREEN OCHRE of *Germany*.
7. Black Ochre.

* There is also a pure yellow Ochre of Chalybeate Springs, which is the Earth of Iron.

This

Variety of Variety,

This *hard Ochre* takes in *Clay*, and becomes,

The HEAVY OCHRE of *Yorkshire*.

This takes in *Lead*, and becomes,

The GIALLOLINO OF NAPLES.

This *Sil Atticum* takes in *Chalk* and *Bole*, and becomes,

The BENGAL EARTH.

This *Terra Sinopica* takes in *White Bole* and *Clay*, and becomes,

The VENETIAN RED BOLE *.

This *Green Ochre* of *Germany* takes in *Copper*, and becomes,

GREEN MINE OCHRE.

* This *Venetian Red* takes in *Iron*, and becomes,

The PERSIAN EARTH of *Ormuz*.

D

Genus

Genus. Species.

Variety.

Tripelas,

In their Ascent to *Boles*, assume the following Names and Characters.

1. White Tripela—The *Creta Argentaria* of the Antients.

This takes in *Ochre*, and becomes,

The COMMON TRIPELA, or Gleb
Alana.

blue Clay, and becomes,

The TERRA MELIA of *Dioscorides*.

Spar, and becomes,

HARD CHALK.

2. Brown Tripela—called *Rotten Stone*.

This takes in *Spar*, and becomes,

The FRENCH ROTTEN STONE.

Talc, and becomes,

The WILTSHIRE ROTTEN STONE.

3. *Red Tripela*.

This takes in *Talc*, and becomes,

LAMINATED TRIPELA.

These several Varieties are not found to admit of any other
Mixture.

D 2

Genus.

These

Genus. Species.

Variety.

Boles,

In their Ascent to *Clays*, assume the following Names and Characters.

1. White Bole—The *White Bole Armenic* of the Shops.

This takes in *Chalk*, and becomes,

The FRANKFORT EARTH of the Shops.
Marle, and becomes,

The TERRA LIGNICENSIS of the Shops.
Clay, and becomes,

The TERRA MELITENSIS of the Shops.
Spar, and becomes,

The WHITE TUSCAN EARTH.

Cryстал, and becomes,

The TERRA LEMNIA ALBA of the Shops.

2. Yellow Bole—The *Yellow Lemnian Earth* of the Shops.

This takes in *Marle*, and becomes,

The TERRA LIGNICENSIS LUTEA of the Shops.

Clay, and becomes,

The BOLUS TOCCAVIENSIS of the Shops.

Spar, and becomes,

The BOLE ARMENIC OF GALEN.

Iron, and becomes,

The TERRA LIVONICA LUTEA of the Shops.

Copper, and becomes,

The GREEN BOLE of England.

3. Brown Bole—The *Silesian Bole*, or *Axungia Solis*.

This takes in *Marle*, and becomes,

The PALE GERMAN BOLE.

Clay, and becomes,

The GOSSELAER BOLE.

4. Orange Bole—The *Bolus Bohemica* of Kentman.

5. Red Bole—*Red Bole Armenic*.

This takes in *Marle*, and becomes,

The CAROLINA BOLE.

Tripela, and becomes,

The TERRA PORTUGALICA of the Shops.

Clay, and becomes,

The TERRA SIGILLATA RUBRA MAGNE DUCIS.

Variety of Variety.

This *Frankfort Earth* takes in *White Clay*, and becomes,
BENGAL BOLE.

This *Malta Earth* takes in *Natron*, and becomes,
The TERRA ERETRIA of the Antients.

This *Goffelaer Bole*, takes in *Pinigitis*, and becomes,
SPOTTED BOLE. 16.

This *Bole Armenic* takes in *Bitumen* and *Natron*, and becomes,
The TERRA LEMNIA RUBRA.

This *Carolina Bole* taking in *Spar*, becomes,
The BOLE OF BLOIS.

This *Portugal Earth* taking in *Marle*, becomes,
The TERRA TURCICA of the Shops.

This *Tuscan Earth* taking in *Marle*, becomes,
The TERRA LIVONICA of the Shops.
Spar and *Clay*, becomes,
The EARTH OF STRIGA.

Genus. Species.

Variety.

Clays,

As they advance in Purity, assume the following Names and Characters.

1. White Clay—*Tobacco Pipe Clay* of *Pole*.
This takes in *blue Clay*, and becomes,
The PIPE CLAY of *Northampton*.
Spar, and becomes,
The PARETONIUM of the Antients.
2. Yellow Clay—*Brewers Clay*.
This takes in *Chalk*, and becomes,
The YELLOW POT EARTH of *Staffordshire*.
Crystal, and becomes,
HEDGERLY LOAM.
White Sand, and becomes,
NORTHAMPTONSHIRE POT EARTH.
Pale yellow Sand, and becomes,
COMMON LOAM, or Brick Earth.
3. *Brecon Clay*—from *Chedder Rocks*.
This takes in a fine *black Marle*, and becomes,
The MARBLED EARTH OF *LEMNOS*.
Selenites, and becomes,
FINE TILE CLAY.
Yellow Sand, and becomes,
FOUNDERS CLAY.
4. Blue Clay—in the Cracks of Strata.
This takes in *Marle*, and becomes,
The COARSE POT EARTH of *Leicestershire*.
Bole, and becomes,
One of the CHINA EARTHS.
Yellow Sand, and becomes,
SHROPSHIRE POT EARTH.
Talc, and becomes,
The NORTHAMPTON CLAY.
5. Green Clay—from *Ochre Pits*.
This takes in *Marle*, and becomes,
The MENDIP CLAY.
Selenites, and becomes,
The DORSET CLAY.
6. Red Clay.—*Mahogany Earth* of the *Isle of Wight*.
This takes in *Spar*, and becomes,
The FINE RED STAFFORDSHIRE EARTH.
Crystal, and becomes,
The PALE STAFFORDSHIRE EARTH.
7. Black Clay—The *Pnigites* of *Galen*,
This takes in *White Clay*, and becomes,
The SUSSEX PIPE CLAY.

Variety of Variety.

- This *Northampton Pipe Clay* takes in *yellow Sand*, and becomes,
COMMON POT EARTH.
White Sand, and becomes,
The HARSH CLAY OF STAFFORDSHIRE
Brown Sand, and becomes,
The FINE STAFFORDSHIRE EARTH.
Large pale yellow Sand, and becomes,
FINE GREY BRICK EARTH.
- This *Paretonium* takes in *White Sand*, and becomes,
GOLT.
Yellow Sand, and becomes,
LEICESTERSHIRE POT EARTH.
- This *yellow Stafford Earth* takes in *Crystal Sand*, and becomes,
POOR EARTH OF STAFFORDSHIRE.
Talc, and becomes,
SHROPSHIRE BRICK EARTH.
With *yellow and white Sand* and *Talc*,
DORSET BRICK EARTH.
- This *Tile Clay* taking in *white Clay*, becomes,
The HARD STAFFORDSHIRE EARTH.
Spar, becomes,
The OXFORDSHIRE FLOOR CLAY.
- This *Founders Clay* takes in a *large white Sand*, and becomes,
The RED BRICK CLAY.
Garden Mould, and becomes,
TILLAGE LAND.
- This *Shropshire Pot Earth* takes in *Spar*, and becomes,
GALLYPOT EARTH.
Selenites, and becomes,
BLUE BRICK EARTH.
- This *Mendip Clay* takes in *Spar*, and becomes,
The GREEN HAMPSHIRE EARTH.
- This *Staffordshire Red* takes in *Spar*, and becomes,
The PURPLE STAFFORDSHIRE EARTH.
Brown Clay, and becomes,
COARSE BRICK EARTH.
Iron, and becomes,
The RED LAND of *Roswell*.
- This *Sussex Pipe Clay* takes in *Selenites*, and becomes,
The LIGHT MENDIP CLAY.

And in this Manner may the whole Fossil World be arranged, upon the certain Principles of Decomposition, and the specific Gravities of the several separate Parts: It will be a Work of Time; but the Plan is here.

F I N I S.

